

Saito, I., and K. Ishioka, 2016: On a quasi-invariant associated with the emergence of anisotropy in two-dimensional turbulence on a rotating sphere. *J. Meteor. Soc. Japan*, 94, 25-39.

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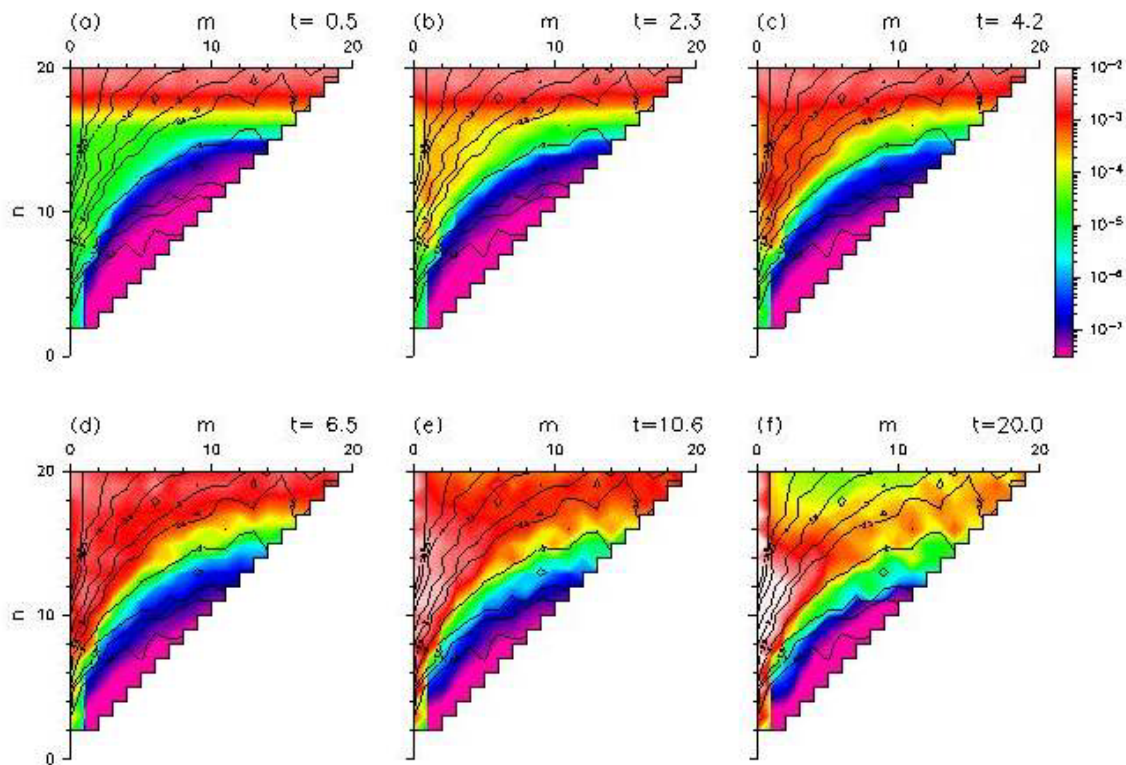


Figure 1. Snapshots of the ensemble-averaged two-dimensional energy spectrum. Ordinate is the total wavenumber while the abscissa is the zonal wavenumber. Corresponding times are written in the upper right of each panels. Solid curves are the coefficient ( $10^x$ ) of the quasi-invariant obtained by the minimization process.

- A quasi-invariant for the vorticity equation on a rotating sphere is obtained by a minimization process.
- The distribution of the weighting coefficient for the quasi-invariant has airfoil-shaped contours (Fig. 1, solid curves), with which the anisotropic energy transfer that favors zonally elongated structures can be explained.
- Freely-evolving turbulence experiments confirm that the quasi-invariant is conserved well when the nonlinearity of the system is sufficiently weak.
- When the quasi-invariant is conserved well, energy is transferred in the wavenumber space apparently along the airfoil-shaped contours of the weighting coefficient for the quasi-invariant (Fig. 1).